IMPROVED YIELDS WITH MULCHING ON MICROIRRIGATED VEGETABLES

H. S. Chauhan[1]

ABSTRACT

Drip irrigation has been used extensively for vegetable and fruit crops for saving water and fertilizer and improving quality of products. Similarly, mulching has been used quite a bit for moisture conservation. A combination of drip irrigation was found to improve moisture conservation and crop production quality. There are several types of mulches made of plastic sheets of various materials, thickness and color, with varying costs and overall performances. Similarly, agricultural crop residue such as paddy husk and coir pith have been often used as mulches.

in several studies at different locations it was found that drip irrigation increased total and marketable yields of tomatoes compared with unirrigated plots by 16 and 28 percent whereas mulching increased the total and marketable yields by about 24 and 20 percent respectively. Similarly, drip irrigation generally gave higher yields ranging from 40 to 53 percent and water saving of 28-54 percent. The mulching generally increased the total and marketable yields in all the years including the early yield in one year. Generally black polyethylene mulch gave better yields than the other materials.

Similarly, in various studies it was found that frequent surface irrigation of potatoes gave higher yields. Mulching along with surface irrigation gave still better yields say about 30 percent. Comparative studies showed that yields increased from 31percent to 90 percent with drip irrigation .

In a study of drip and irrigation of muskmelon with black plastic mulch indicated that the highest water use efficiency was with drip tape irrigation and plastic mulch, averaging 9.10kg-fruit per cu m of water used, and the lowest water use efficiency was found for the control treatment with 3.6 kg/m^3 of water used.

INTRODUCTION

Drip irrigation has been used extensively for vegetable and fruit crops for saving of water and fertilizer and improvement in quality of produce. Similarly mulching has been used quite a bit for moisture conservation. A combination of drip irrigation has found to improve moisture conservation and crop produce quality. There are several types of mulches made o plastic sheets of various materials, thickness and color, with varying costs and their overall performance .Similarly agricultural crop residue sometimes as byproduct such as paddy husk and coir pith have been often used as mulches

In several studies at different locations it was found that drip irrigation increased total and marketable yields of tomatoes compared to unirrigated plots by 16 and 28 percent

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whereas mulching increased the total and marketable yields by about 24 and 20 percent respectively.
In some locations yields even doubled with drip irrigation.It was found that the mulching generally increased the total and marketable yields in all the years including the early yield in one year. Generally black polyethylene mulch gave better yields than the other materials. The combined treatments of irrigation + mulching with black polyethylene showed higher increase in total and the marketable yield. An important aspect of black mulch was its being able to reduce weed infestation by about 95 percent.
In studies conducted at various locations, it was found that frequent surface irrigation of potatoes gave higher yields. Mulching along with surface irrigation gave still better yields say about 30 percent. Comparative studies of with drip irrigation showed that yields increased from 31percent to 90 percent with drip irrigation .
In this paper the performance of various mulches available from several earlier works for tomatoes, potatoes melons, muskmelon and pumpkins have been reviewed and conclusions drawn.

1.1. REVIEW OF STUDIES ON TOMATOES

1.1.1. Trickle, white and black polyethylene, non- woven polypropylene and yield.

Kaniszewski (1994) studied the response of tomatoes to trickle irrigation in a three year field trial with mulching of polyethylene and non-woven polypropylene. The irrigation was carried out with two or four laterals per plant, and two types of black and white polyethylene mulches and black non-woven polypropylene mulch were used. He reported that the mulching generally increased the total and marketable yields in all the years and for the early yield in one year. Only black polyethylene mulch gave better yields than the other two materials. The combined treatments of irrigation + mulching with black polyethylene showed highest increase in total yield and also in the marketable yield.

1.1.2. Drip, polyethylene mulch, different moisture regimes, water saving, and yield

Shrivastava et al. (1994) studied in India the effect of drip irrigation and mulching on tomato by using three moisture regimes at 0.4, 0.6 and 0.8 of pan evaporation combined with no mulch, black plastic and sugarcane trash mulch. Highest yield of 51 tones/ha and 44 percent saving in irrigation water were obtained by using the combination of trickle irrigation at 0.4 level of pan evaporation and polyethylene mulch. This treatment also gave the maximum yield of 163 kg/ha-mm of water applied. The treatment combining drip irrigation at 0.4 pan evaporation and polyethylene with black plastic mulch reduced weed infestation by 95 percent increased the yield by 53 percent, resulting in 44 percent saving in irrigation water as compared to surface flooding without mulch.

1.1.3. Trickle irrigation and mulching

Elkaner et al (1995) carried out studies on effect of trickle irrigation and mulching on quality of tomato fruits. They found that the irrigation increased the total and marketable

yields by about 16 and 28 percent as compared to unrelated plots, whereas mulching increased the total and marketable yields by about 24 and 20 percent respectively.

1.1.4. Trickle irrigation and cracking of Cherry tomatoes

Maroto et al. (1995) studied the influence of irrigation doses on cracking response in 'Cherry' tomato fruits with three kinds of different trickle irrigation treatments at the rate of 0.5, 1.0, and 1.50. They found an increase in fruit yield and fruit weight with increase in amount of water.

1.1.5. Drip irrigation, mulching and yield

Occasion and Smajstrla (1996) studied the effect of amount of water application and mulches for 3 years on irrigated tomatoes by applying water at 0.00, 0.25, 0.50, 0.75, and 1.00 times pan evaporation in one application per day. They found that fruit yield gets doubled with drip irrigation. The total yield was found highest with irrigation quantities of 0.75 and 1.00 times pan evaporation and significantly lower with 0.25 and0.50 times pan evaporation values.

1.1.6. Drip irrigation mulch yield and water saving

Riana et al(1998) studied at Solan, Himanchal Pradesh, India, on a loamy sand soil the effect of surface and drip irrigation and plastic mulch on fruit yield and water saving. Drip irrigation at .8V (volume of water applied to 80 percent ET crop) gave significantly higher fruit yields, 166.3 q/ha than what the surface irrigation gave. Plastic mulch plus drip irrigation further raised the yield to232.5q/ha. Water use efficiency under drip irrigation alone, drip irrigation plus plastic mulch, and surface irrigation was 3 .41, 4.80 and 1.67 q/hacm. A saving of 54% of irrigation water resulted in drip irrigation giving 40 percent higher Unit yield as compared to surface irrigation.

1.1.7 Drip, surface irrigation, polyethylene, and coir mulch, and yield

Asokaraja (1998) studied the response of tomato to drip irrigation levels and mulches. The results showed that drip irrigation had twin benefits of yield increase and water saving in ****tomato. Drip irrigation at 75 percent of surface irrigation had registered 46 % and 50% increase in yield and 35 % and 28% water saving as compared to surface irrigation at .8 IW/CPE ratios with 5 cm depth. Polythene film of 100 micron and raw coir pith at 12.5 t/ha as mulches were

1.2. NFERENCES FROM REVIEW ON TOMATOES

1.2.1. Studies at Sloan, India, on a loamy sand soil and for the effect of drip surface irrigation and plastic mulch showed that Drip irrigation at .8V (volume of water applied to

80 percent ET crop) gave significantly higher fruit yields, 166.3 q/ha than what the surface irrigation gave. Plastic mulch plus drip irrigation further raised the yield to232.5q/ha. Water use efficiency under drip irrigation alone, drip irrigation plus plastic mulch and surface irrigation was 3 .41, 4.80 and 1.67 q/ham. A saving of 54% of irrigation water resulted in drip irrigation giving 40 percent higher fruit yield as compared to surface irrigation. (48)

1.2.2. Studies on effect of trickle irrigation and mulching on quality of tomato fruits showed that the irrigation increased the total and marketable yields by about 16 and 28 percent as compared to unirrigated plots, whereas mulching increased the total and marketable yields by about 24 and 20 percent respectively. (41)

1.2.3. The influence of irrigation doses on cracking response in 'Cherry' tomato fruits was studied with three kinds of different trickle irrigation treatments at the rates of 0.5, 1.0, and 1.50. It was found that there was an increase in fruit yield and fruit weight with increase in amount of water. (42)

1.2.4. The effect of amount of water application and mulches were studied for three years on irrigated tomatoes by applying water at 0.00, 0.25, 0.50, 0.75, and 1.00 times pan evaporation in one application per day. They found that fruit yield gets doubled with drip irrigation. The total yield was found highest with irrigation quantities of 0.75 and 1.00 times pan evaporation and significantly lower with 0.25 and0.50 times pan evaporation values. (44)

1.2.5. The response of tomatoes to trickle irrigation was studied in a three- year field trial with mulching of polyethylene and non-woven polypropylene. The irrigation was carried out at two or four laterals per plant and two types of black and white polyethylene mulches and black non-woven polypropylene mulch were used. It was found that the mulching generally increased the total and marketable yields in all the years and for the early yield in one year. Only black polyethylene mulch gave better yields than the other two materials. The combined treatments of irrigation + mulching with black polyethylene showed highest increase in total yield and also in the marketable yield. (33)

1.2.6. The effect of black polyethylene mulch and trickle irrigation was studied as applied to tomato at 0.0, 0.25, 0.50, 0.75 and 1.0 times pan evaporation. The fruit yields increased substantially by trickle irrigation. The total marketable yields were found highest at 0.75 pan and 1.0 pan as compared with control treatment. (34)

1.2.7. In India the effect of drip irrigation and mulching on tomato was studied by using three moisture regimes at 0.4, 0.6 and 0.8 of pan evaporation combined with, no mulch, black plastic mulch, and sugarcane trash mulch. Highest yield of 51 tones/ha and 44 percent saving in irrigation water were obtained by using the combination of trickle irrigation at 0.4 level of pan evaporation and polyethylene mulch. This treatment also gave the maximum yield of 163 kg/ha-mm of water applied. The treatment combining drip irrigation at 0.4 pan evaporation and polyethylene with black plastic mulch reduced weed infestation by 95 percent increased the yield by 53 percent, resulting in 44 percent saving in irrigation water as compared to surface flooding without mulch. (35)

1.2.8 In a study of effect of drip irrigation and mulches on tomato in India it was found that drip irrigation at 75 percent of surface irrigation had registered 46 % and 50% increase in yield and 35 % and 28% water saving as compared to surface irrigation at .8 IW/CPE ratio with 5 cm depth. Polythene film100 micron and raw coir pith at 12.5 t/ha as mulches were found to be superior to sugar cane trash and control in giving higher yields. (49)

1.2.9 In a study of sub irrigation of tomato with polyethylene mulch, it was found that yield and fruit quality were not significantly different, but there was a reduction of irrigation water by about 50 percent of pan evaporation for trickle irrigation method as compared to sub irrigation. (30)

Summary Tomato

In several studies at different locations it was found that drip irrigation increased total and marketable yields of tomatoes compared to unirrigated plots by 16 and 28 percent Whereas mulching increased the total and marketable yields by about 24 and 20 percent respectively.
Similarly drip irrigation generally gave higher yields ranging from 40 to 53 percent and water saving of 28-54 percent the yields were found higher with larger quantities of water of irrigation at .75-1.0 pan evaporation. In some locations yields even doubled with drip irrigation
It was found that the mulching generally increased the total and marketable yields in all the years including the early yield in one year. Generally black polyethylene mulch gave better yields than the other materials. The combined treatments of irrigation + mulching with black polyethylene showed higher increase in total and the marketable yield. An important aspect of black mulch was its being able to reduce weed infestation by about 95 percent.
However applying sub irrigation to tomato with polyethylene mulch, it was found that yield and fruit quality were not significantly different, but there was a reduction of irrigation water by about 50 percent of pan evaporation for trickle irrigation method as compared to sub irrigation.

2.1. REVIEW OF STUDIES OF MULCHING ON POTATOS

2.1.1. Drip irrigated with nutrient solution, planted on 100 cm spacing yielded more under plastic mulch grown on twin row spacing

1.4. Phene and Saunders (1976) carried out experiments in the U.S.A. to study the effect of drip irrigation on potatoes under controlled soil matric potential, and the effect of two row spacing, on the yield quality and nutrient contents of potato. The potatoes, drip irrigated with nutrient solution, and planted on 100 cm row spacing on sandy loam soil yielded more marketable potatoes than potatoes which were drip irrigated under plastic mulch and grown on twin row spacing, and 206 percent more than 100cm spaced non irrigated potatoes. With drip irrigation the N and Mg contents of the tuber were also increased.

2.1.2. Surface irrigation straw mulch and yield

Burgers and Nel (1984) investigated the effect of straw mulching and irrigation frequency on potato tuber yield. They found that mulched plots produced 30 per cent more tubers than bare plots. Tuber yields also responded well to irrigation frequency. It was concluded that cooling effect of frequent irrigation could be obtained much cheaper by mulching. It was recommended that from commencement of stolonization, potatoes should be irrigated with 50 mm of water at IW/CPE of 1.00 and 0.77, respectively without and with mulch.

2.1.3. Sprinkler and drip irrigation mulching and yield

Zaag et al. (1985) irrigated potatoes through sprinklers under mulched and non-mulched conditions at four, eight and twelve day interval with a total water of 468, 268 and 208 mm, respectively. Un-irrigated control plots received 78 mm rainfall. The highest tuber yield (28 t/ha) was obtained from potatoes irrigated at four days interval, followed by 19.5 t/ha. in both eight and twelve day intervals, respectively with mulching and 13 t/ha. and 12 t/ha. Without mulching. In the control plot 10.2 and 7.2 t/ha. of potatoes were harvested with and without mulching. In another experiment with drip system they harvested 21 t/ha. Of potato, which is equal to that of sprinkler but drip system used only 400 mm water against 620 mm of sprinkler system.

2.1.4. Six to Seven irrigations without mulch and 4 to 5 irrigations with mulch. Increased yield compared to 6 or7 irrigation without mulch Mulching increased tuber yield by 4 t/ha.
Saga et al. (1997) tested four different irrigation schedules, such as unirrigated control and irrigation at 20, 40 and 60 per cent depletion of available soil moisture on potato cv. cardinal with or without a 15 cm thick rice straw mulch in Bangladesh. The permissible limit of available soil moisture depletion was within 20 to 40 per cent to achieve a high yield target from potatoes under the edaphic and climatic settings of the experimental area. This required 6 to 7 irrigations without mulch and 4 to 5 irrigations with mulch. Mulching increased tuber yield by 4 t/ha. Averaged across irrigation
2.1.5Drip system at 80 % moisture with plastic mulch yielded maximum
And minimum for surface irrigation at100 % moisture l without mulch.
Jain et al (2001*)* studied drip and surface irrigation with and without mulch on potato cultivar Kufri Badshah using three levels of moisture regimes in a sandy loam soil at Pantnagar in north India. The experiment consisted of eight treatments replicated three times. In drip irrigated plot one lateral was provided to each row. Emitters of a capacity 4 l/h were provided at a spacing of 50 cm as online drippers. The potato yield for treatments irrigated with drip system at 80 % irrigation moisture regime in combination with plastic mulch was found to be maximum as 30 .45 t/ha and minimum it being 18.44 t/ha for the control i.e. surface irrigation at100 % moisture level without mulch. The yield for other treatments varied from 19.58 to20.41 t/ha... The highest water use efficiency was found to be 3.24t/ha-cm for the treatment irrigated with drip system at 80 percent level with mulch as compared to 2 .17 t/ha- cm for the control treatment.

2.2. INFERENCES FROM REVIEW ON POTATOES

2.2.1. Experiments were done in the U.S.A. of the effect of drip irrigation on potatoes under controlled soil matric potential, and the effect of two row spacing, on the yield quality and nutrient contents of potato. The potatoes, drip irrigated with nutrient solution,

and planted on 100 cm row spacing on sandy loam soil yielded more marketable potatoes than potatoes which were drip irrigated under plastic mulch and grown on twin row spacing, and 206 percent more than 100cm spaced non irrigated potatoes.

2.2.2. The effect of straw mulching and irrigation frequency on potato tuber yield was studied. They found that mulched plots produced 30 per cent more tubers than bare plots. Tuber yields also responded well to irrigation frequency. It was concluded that cooling effect of frequent irrigation could be obtained much cheaper by mulching. It was recommended that from commencement of colonization, potatoes should be irrigated with 50 mm of water at IW/CPE of 1.00 and 0.77, respectively without and with mulch crop. (14)**.**

2.2.3. In a study of sprinkler irrigated potatoes with mulch and non mulched condition it was found that the highest tuber yield (28 t/ha) was obtained from potatoes irrigated at four days interval, followed by 19.5 t/ha. In both eight and twelve day intervals, respectively with mulching and 13 t/ha. and 12 t/ha. without mulching. In the control plot 10.2 and 7.2 t/ha. Of potatoes were harvested with and without mulching.

2.2.4. In a study at Bangladesh four different irrigation schedules, were tested such as UN irrigated control and irrigation at 20, 40 and 60 per cent depletion of available soil moisture on potato co. cardinal with or without a 15 cm thick rice straw mulch. The permissible limit of available soil moisture depletion was within 20 to 40 per cent to achieve a high yield target from potatoes under the edaphic and climatic settings of the experimental area. This required 6 to 7 irrigations without mulch and 4 to 5 irrigations with mulch. Mulching increased tuber yield by 4 t/ha. Averaged across irrigation.

2.2.5. Studies of drip and surface irrigation with and without mulch on potato cultivar Kufri Badshah using three levels of moisture regimes in a sandy loam soil at Pantnagar in north India. Showed that the yield for treatments irrigated with drip system at 80 % irrigation moisture regime in combination with plastic mulch was maximum as 30 .45 t/ha and minimum it being 18.44 t/ha for the control i.e. surface irrigation at100 % moisture level without mulch.

3.1. REVIEW OF STUDES F MULCHING ON CHILIS

3.1 1. Drip, mulch, fumigation, control and yield. Of pepper.

Kays et al. (1976) grew pepper (Capsicum frutescent) using drip irrigation with Different treatments. Highest combined yield was obtained with film mulch + soil fumigation (117.6t/ha) followed by film mulch (112.3 t/ha), soil fumigation (93.4 t/ha) And control (69.1 t/ha) respectively.

3.1.2 Drip systems, mulch, growth and yield

Shinde et al (1999) studied the effects of six micro-irrigation systems (MIS) and three mulches on microclimate growth and yield of summer chili. Soil temperature was highest in the control and lowest under sugarcane trash mulch. The average humidity was greatest with micro tubing at 08.30 h and with the rotary micro sprinkler at 14.30 h. Plant

height and number of branches was greatest with sugarcane trash mulch. The yield of green chili was highest (12.2 t/ha) with sugarcane trash mulch. The weekly crop coefficient (kick) values were in the ranges 0.47-0.95, 0.42-0.86, 0.40-0.84 and 0.38-0.83 for summer chili treated with no mulch, transparent plastic, black plastic and sugarcane trash, respectively.

3.1.3. Microjet, Drip, Mulching yield,WUE, BC Ratio

Shinde et al;2002 studied the effects of micro-irrigation, in combination with mulching, on the production of chili [Capsicum annuum] cv. Pusa Jwala in Dapoli, Maharashtra, India The treatments comprised 50 or 70% microjet irrigation with or without mulching, and 40, 50 and 60% drip irrigation with or without mulching. Micro jet irrigation (50%) with mulching resulted in the highest plant spread (39.93), average number of fruits per hill (248.60), average weight of fruits per hill (538.93 g) average weight of fruits (2.19 g) and yield (20.34 q/ha), as well as the highest gross income (Rs. 244080/ha), net returns (Rs. 100956.24/ha), benefit cost ratio (1.70) and net extra income over the control (Rs. 51628.05/ha). Water use efficiency was highest in 25% drip irrigation with mulching (447.18 kg ha-1 cm-1) followed by 50% micro jet irrigation with mulching (312.92 kg ha-1 cm-1).

INFERENCES FROM REVEW ON CHILIS

3.2.1. Pepper (Capsicum frutescens) was subjected to drip irrigation combined with Different treatments. In a study of effect of different mulches it was found that highest, Combined yield was obtained with film mulch + soil fumigation (117.6 t/ha), followed by film Mulch (112.3 t/ha), soil fumigation (93.4 t/ha), and control (69.1 t/ha) respectively.

3.2.2. The effects of six micro-irrigation systems (MIS) and three mulches on microclimate growth and yield of summer chilli were studied. Soil temperature was highest in the control and lowest under sugarcane trash mulch. The average humidity was greatest with micro tubing at 08.30 h and with the rotary micro sprinkler at 14.30 h. Plant height and number of branches was greatest with sugarcane trash mulch. The yield of green chili was highest (12.2 t/ha) with sugarcane trash mulch. The weekly crop coefficient (kc) values were in the ranges 0.47-0.95, 0.42-0.86, 0.40-0.84 and 0.38-0.83 for summer chilli treated with no mulch, transparent plastic, black plastic and sugarcane trash, respectively. (23)

3.2.3. Study of micro irrigation systems, micro jet and drip, with or without mulching, of chili in Maharashtra, India, with different amounts of irrigation application through these systems showed that Micro jet irrigation (50%) with mulching resulted in the highest yield components and yield (20.34 q/ha), as well as the highest net returns (Rs. 100956.24/ha), benefit cost ratio (1.70) and net extra income over the control (Rs. 51628.05/ha). Water use efficiency was highest in 25% drip irrigation with mulching (447.18 kg ha-1 cm-1) followed by 50% micro jet irrigation with mulching (312.92 kg ha-1 cm-1).28

4.1. REVIEW OF STUDIES OF MULCHING ON Melons/Watermelons

4.1.1. Drip, plastic mulch, growth and yield

Bella and Kwolek (1984) studied the response of cucurbits to drip irrigation and black plastic mulch. They found that drip irrigation and plastic mulch each increased plant growth, early bloom and yield.

4.1.1.Drip, black plastic mulch and yield.

Bhella (1988) studied the response of Curcumas melon L. Cv. Charleston grey with two factorial combinations of drip irrigation or no irrigation and black polyethylene mulch or no mulch for two successive years. Both drip irrigation and polyethylene mulch along and in various combinations increased stem growth and early and total yields compared with untreated controls. Greatest stem growth and early and total yields were obtained from plants grown under polyethylene mulch in combination with drip irrigation. It was observed that drip irrigated plants induced shallow rooting near the drip emitters whereas non irrigated plants produced relatively extended deep and diffuse roots.

4.1.2Drip, furrow, mulch and yield.

Fipps and Perez (1995) studied micro irrigation of melons in the Lower Rio Grande valley of Texas. Components of this system consisted of inexpensive drip strip tubing (commonly termed as 'tape'), plastic mulch, lay flat tubing and portable pumping and filtration trailers. Two cases were considered in the study, the drip under plastic mulch and furrow irrigation. For both cases under study precipitation was 66 mm. Irrigation water provided in drip was 112 mm and in furrow 333 mm. eight irrigations were given through drip, whereas in furrows, seven irrigations were given. Nitrogen was provided in drip at the rate of 68 kg per hectare, whereas in furrow it was given at the rate of 177 kg /ha. The yield in terms of boxes was 1233 boxes/ha in the drip, whereas in furrow it was 741 boxes/ha. (One box =0.14 cu m). Water use efficiency in case of drip was 6.9/ mm (boxes/total water), and in case of furrow it was 1.8 mm. Nitrogen use efficiency in terms of boxes per application rate for drip it was 18.1/kg/ha whereas for furrow it was 4.2/kg/ha.

From the above studies, inferences have been drawn on the performance of drip irrigation on Water Melon and Melon, as compared with other methods of irrigation as below

INFERENCES FROM REVIEW, Melons

From the above studies, inferences have been drawn on the performance of drip irrigation on Muskmelon, as compared with other methods of irrigation as below

4.2.1. Study was conducted on the response of cucurbits to drip irrigation and black plastic mulch. It was found that drip irrigation and plastic mulch each increased plant growth, early bloom and yield. (3)

4.2.2. It was found in studies in India that both drip irrigation and polyethylene mulch along and in various combinations increased stem growth and early and total yields compared with untreated controls. Greatest stem growth and early and total yields of Curcumas Melo were obtained from plants grown with polyethylene mulch in combination with drip irrigation. It was observed that drip irrigated plants reduced shallow rooting near the drip emitters whereas non irrigated plants produced relatively extended deep and diffuse roots.(3)

4.2.3. Studies of micro irrigation of melons was conducted in Texas, USA. The system consisted of drip 'tape,' plastic mulch; lay flat tubing and portable pumping and filtration trailers. Treatments consisted of the drip under plastic mulch and furrow irrigation. For both precipitations were 66 mm. Water provided in drip was 112 mm and in furrow 333 mm; in drip 8 irrigations whereas in furrow 7 irrigations were given. Nitrogen was provided in drip at the rate of 68 kg/ha, whereas in furrow it was given at the rate of 177 kg/ha. The yield in terms of boxes was 1233 boxes/ha in drip whereas in furrow it was 741 boxes/ha. (One box =0.14 cu m). Water use efficiency in case of drip it was 6.9/ mm (boxes/total water), and in case of furrow it was 1.8mm.Nitrogen use efficiency in terms of boxes per application rate for drip was 18.1/kg/ha, whereas for furrow was 4.2/kg/ha.(5)

5.0. REVIEW OF STUDIES ON MUSKMELON

5.1.1. Drip tape, furrow, mulch and yield

Briones et al(1995) carried out a study through field trials to evaluate water use efficiency, yield, quality for muskmelon plants with drip tape and soil mulching on a fine textured soil. The treatments for the main blocks were, A1) drip tape irrigation A2) furrow irrigation, and for subplots,B1) black plastic mulch 37.5 micron thickness, B2) black plastic mulch 22 micron thickness, or B3) control, without mulch. When the crop developed on bare soil irrigated by furrow its water consumption was higher than for plants with drip tape under plastic mulch (interactionsA1B1 orA1B2). The combination A1B1 increased the muskmelon average yield unto 49.6 tons/ hectare while surface irrigation without mulching (A2B3) averaged about 33.5 tons per hectare. The marketable muskmelon yields size was bettered as much as 54 and 31 percent. The highest water use efficiency was got with drip tape irrigation and plastic mulch, averaging 9.10kg-fruit per cu m of water used, and lowest water use efficiency was found for the control treatment which gave 3.6 kg per cu m of water used.

INFERENCE FROM REVIEW

From the above studies, inferences have been drawn on the performance of drip irrigation on Muskmelon, as compared with other methods of irrigation as below

.**5.2.1**The treatments for the main blocks were A1) drip tape irrigation, A2) furrow irrigation; and for subplots,B1) black plastic mulch 37.5 micron thick, B2) black plastic mulch 22 micron thick, or B3) control, without mulch. Drip tape with black plastic mulch increased the musk melon average yield upto 49.6 t/ha, while surface irrigation without mulching averaged 33.5 tons/ha. The marketable musk melon yield size was bettered by 54 and 31%. The highest water use efficiency was got with drip tape irrigation and

plastic mulch averaging 9.10kg-fruit per cu m of water, and lowest water use efficiency was found for the control treatment which gave 3.6 kg per cu m of water (9).

6.0. REVIEW OF STUDIES ON PUMPKIN

6.1.1. Drip, raised beds planting, mulches different spacings and yield

White 2001 carried out studies on hybrid SS13, a semi-bush tropical pumpkin (calabash), Cucurbita moschata, in Florida, USA, on polyethylene-mulched raised beds with drip irrigation to evaluate the effects on yield and fruit size of 3- and 4-foot spacing. There were seven black mulches at two thicknesses, two black on white, two white, three silver, two blue, and one each of black, olive, red, green, and brown for a total of 28 types of mulch. Plots were 50 feet long with four replications in a randomized complete block design. Transplanting occurred on 6 September. An early freeze occurred on 22 November, terminating vine growth and fruit development. Fruit diameter ranged between 3.6 and 8.3 inches and was not affected by mulch type. The 4-foot spacing was higher than the 3-foot spacing in fruit diameter, number of fruit, and fruit weight per plant. But, the 3-foot spacing had a higher yield per acre than the 4-foot spacing (367 versus 317 cwt.).

6.2.2 Studies was conducted in Florida, USA, on the response of polyethylene-mulched raised beds with drip irrigation on yield and fruit size with different spacings and different mulches. There were a total of 28 types of mulches in the treatments
Transplanting occurred on 6 September. An early freeze occurred on 22 November, terminating vine growth and fruit development. Fruit diameter ranged between 3.6 and 8.3 inches and was not affected by mulch type. The 4-foot spacing was higher than the 3-foot spacing in fruit diameter, number of fruit, and fruit weight per plant. But, the
3-foot spacing had a higher yield per acre than the 4-foot spacing (367 versus 317 cwt.).

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